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Second Annual Ewing Lecture

by

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It is a great pleasure for me as a citizen of Oklahoma to be here at the University tonight for the Second Cortez Ewing Foundation Lecture. To those who were students of Dr. Ewing, or knew him intimately, he was not only a great teacher, but also a great political philosopher. He was a man who could penetrate to the essence of a situation and produce a pithy phrase to focus the attention of all on that essence. He knew the value of the pragmatic or experimental approach. He also knew that sound theory and doctrine must underlie effective action by even the greatest leader. He was one of those leaders of men about whom President Edwin A. Alderman of the University of North Carolina said, in pointing to the problems of the development of the South in the first decade of this century, that without such leaders produced by strong, vigorous, and independent universities "mere agitation for better things is but empty foam on the lazy sea of public opinion." He was the kind of man about whom Dwight W. Morrow spoke in the twenties when he said that only the great spirits of the world have the strength to pass happily from one era to another; adding that "the strand of every new age is lined with the wrecks of earnest, high-souled men who had not this strength."

To his generation, Morrow addressed this question: "What happens to families and communities and races that merely live in houses that have been built for them? It is the oldest tragedy in history -- repeated over and over again."

Cortez Ewing knew that every age must build and rebuild the institutions which serve as bridges to connect the old with the new.

Many Oklahomans knew Lee Wiggins, a banker from Hartsville, South Carolina, who served as Under Secretary of the Treasury and then became Chairman of the Atlantic Coastline Railway. Wiggins had that rare quality of individuality that enabled him to transfer the headquarters of the Coastline from New York to Hartsville and install it in the local passenger station so he could walk to work. But the story I want to tell is about the day he graduated from the University of North Carolina. He spent his last emotion-filled moments walking across the campus with Dr. Horace Williams, a Ewing-type intellect and great philosopher and teacher. As they walked along, Wiggins told his teacher and friend that his mind was filled with what he had learned at the great teacher's feet, but that he needed more as he embarked on his own solo flight into the turbulence of the real world. He posed this question: "Dr. Williams, what are the ultimate values?" The great teacher stopped, gazed with great affection into the eyes of his young friend, and answered, "Mr. Wiggins, I would give anything to know."

Can any former student or friend of Cortez Ewing say what his answer would have been had he been asked that question? I cannot, myself, because I saw him only in limited situations. But still I doubt if his answer would have been the same. I remember him most vividly on those occasions when the faculty of this university had to wrestle with difficult but practical matters as they joined their efforts with those industrial and other leaders of the State during the years I served as President of the Frontiers of Science Foundation of Oklahoma, as Chairman of the Advisory Council to the Oklahoma University College of Business Administration, and as Chairman of the University of Oklahoma Southwest Seminars in Public Responsibility. It was always Dr. Ewing who spoke up at the sticky moments for adherence to high ideals, sound principles and ultimate values, but also for recognition of the practical or experimental approach that would take the immediate problem out of the area of semantics and into an area where something could be done. He always wanted the result of action examined in retrospect and both courage and good judgment applied in determining what to do next. He was not one to make the best the enemy of the good, nor permit the symmetry of theory when unattainable in action to form itself into a straitjacket for the actor.

Last year, your first Ewing lecturer, the Honorable Carl Albert, drew the lesson from the life of Dr. Ewing that "the cultural, economic, and industrial future of Oklahoma hinges on the quality and impact of our education." In Albert's words: "We cannot expect economic and industrial progress to develop out of a cultural and intellectual void. We are fast being required to reassess our values."

My own view tonight is that life in every important aspect is becoming more intellectually oriented, the action component of life more dependent on the advancing front of intellectually developed and tested theory. There is little further room for doubt that a high level of basic research, an intellectual activity that must be closely associated with graduate education, is indispensable to an advancing front of scientific knowledge. Technology and engineering flow from this intellectual frontier and, in an increasing number of areas, move hand-in-hand with science. When a segment of the frontier of science has become stable enough to be defined and mapped, perhaps summarized for his colleagues by some able scholar, an innovative engineer or designer conceives some new device or system that was previously considered impossible. He begins to design the components, experiment with their operation, and soon reaches a point when for success there must come into play a different kind of research -- research in support of development. This is still not widely understood, but is well known by those responsible for the very large systems needed in defense and space. This is the process in which this nation is competing to build the supersonic commercial transport. Using this process in this project, we have the opportunity to repeat our experience with the current generation of sub-sonic transports that give mankind the fastest, safest, most reliable and cheapest transportation the human race has ever had. This is the process that Oklahoma's Senator Mike Monroney is so strongly supporting in all fields of aviation and transportation. It is increased participation in this process that Senator Fred Harris is endeavoring to build up and encourage in Oklahoma and the region around it.

In today's world, government works with universities and with industry to marry science, technology, engineering and management to build and put to use the kind of large-scale fully engineered systems on which we must rely for solutions to the problems of organized society, whether in the form of weapons systems for defense; anti-pollution systems for air and water; metropolitan or urban area development systems; weather modification systems; or transportation systems to our sister planets Mars and Venus.

Much of what we do with our intellects today is done in the name of science. For a few hundred years, man has devoted vast talent to learning more and more about this planet Earth, about the physical properties and qualities of the materials and forces which make up so large a part of it, about its characteristics such as gravity and magnetism, and about those semi-earth, semi-solar regions we call the ionosphere and magnetosphere. And there is, of course, that third area where he has used his intellect to penetrate the secrets of life itself, at least life as we know it here on earth.

Until one-third of one generation ago, man had only these three areas within which to work. He could not leave the earth except on the wings of his imagination or along the backward projected lines of travel of the electromagnetic signals he received from outer space. It is truly remarkable that the mind of man, with only the materials of the earth, the characteristics of the earth, and life as it exists on earth to work with could construct valid concepts of reality in the universe man could not reach. These concepts were of the sun, of the solar system, and of the stars and galaxies beyond.

"Science," says C. N. Hinshelwood, "is not the mere collection of facts, which are infinitely numerous and mostly uninteresting, but the attempt of the human mind to order these facts into satisfying patterns * * *." R. E. Gibson calls science, "The study of human experience, the establishment of the validity of this experience, and the fitting of valid experiences into satisfying patterns or structures, which can be communicated unambiguously to others * * to achieve comprehension, understanding, and power of prediction." He also adds, "As the patterns of science are extended, their ability to include more complex subjects grows exponentially and the limits of their application are still far away."

All in all, with this intellectually developed process of inward imaging and outward projection, with powerful tools like telescopes, microscopes, accelerators, and decelerators, we find that almost everything that today occupies the attention of the leaders of all great nations requires what is now called a sophisticated understanding of the atomic processes. Further, we are being rapidly moved toward a similar requirement for a sophisticated understanding of the life processes.

The Cortez Ewing Foundation exists today, I believe, because Marcus Cohn and other Ewing disciples know that it is only on the campuses of great universities like this, the University of Oklahoma, that society finds the full miltidisciplinary flux of knowledge, of additions to knowledge through research, of the iteration and reiteration of knowledge to polish and perfect it. And, in an increasingly large number of cases, it is on the campus that society finds a basis for putting the latest and best knowledge to use in our economic, social, and political system.

How many of us have heard and spoken the words "world without end, Amen," or "out of this world," without recognizing that subtly, almost without realizing it, we no longer think of the earth in using such expressions but rather of the universe itself. Ten years ago next month, Mr. E. K. Gaylord asked me to go to Colorado College to deliver the Commencement Address. This was three months before the Russians orbited Sputnik, which not only impacted the mind of man around the world, but accelerated the improvement of education in Oklahoma. It was two weeks after Mr. J. S. McDonnell of St. Louis gave a speculative timetable for space exploration in a similar graduating exercise at the Missouri School of Mines at Rolla. Thinking to stimulate the Colorado College graduates to think big about the big, wide world, I quoted Mr. McDonnell in these terms:

> In about a dozen years or so, we will launch a satellite that will circle the Earth and Moon.
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> By about 1980, we will have made sufficient advances to permit the launching of a satellite that will circle the Earth and Mars.
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> By about 1990, or 33 years from now, we can go forward to the point of launching a space ship carrying human beings which will circle the Earth for an extended period as a satellite and return safely.
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> By the time you are only a few years older than I am today, you may well take passage on a space ship that will circle the Earth and Mars without landing and return safely.
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> If you live to be about seventy, you may be able to take passage on a vehicle that will land on the Moon and return, and this will weigh about 150 tons and cost ten billion dollars.

If you live to be a hundred, and science may well make this possible, your opportunity will be expanded and you may take passage to land on Mars and return, in a vehicle weighing five hundred tons and costing thirty billion dollars. How long do you think it would take? About 35 days in each direction at a speed of about a million miles a day.

In the intervening ten years, we have produced three generations of lunar spacecraft -- Ranger, Surveyor, and Lunar Orbiter; three generations of manned spacecraft -- Mercury, Gemini and Apollo; four generations of communications satellites and three generations of weather satellites.

It is an interesting fact that five years after I used Mr. McDonnell's timetable, he had produced Mercury and I, serving as Administrator of the National Aeronautics and Space Administration, had flown it.

So little distance can we see as man reaches out to conquer the new environment of space by means of the new rocket technology. Looking backward, we can easily see that it took 37 years for the conquest of the earth's oceans through the use of the new technology incorporated in the Caravelle sailing vessel. Within this span, the explorations of Diaz, Columbus, Vasco da Gama, and Amerigo Vespucci, led on to Magellan -- all this with the first generation of the Caravelle. After that 37 years, the mind of man was never the same again. His concepts of reality included a round earth which could be reached by sailing across the sea and by pioneering on the frontiers of the new lands. Control of the earth's ocean avenues through maintenance of a favorable balance of technological power was a predominant force in the affairs of men for over 400 years, or thirteen generations.

Such a long period was not the case as the technology of the airplane, with its new requirement for three-dimensional control, contested with the older ocean technology. A favorable balance of air technology was a predominant force in the affairs of men for less than 60 years.

Space technology will be a dominant force for longer times than those enjoyed by ocean or air. Not limited as was the ship to the water, or the airplane to the air, or by international boundaries, or to the fuel that its tanks can carry, spacecraft are unlimited tools to explore and measure the environment within which the earth itself moves and has its being. Instead of depending on engines to push or pull them along the course of their journeys, they are propelled upward through the air into the unlimited medium of space and accelerated to speeds at which in earth orbit they achieve dynamic equilibrium. While falling toward the earth, they are going so fast tangentially that they always fall over the earth's horizon. They, therefore, become a falling body, falling round and round the earth, utilizing nature's forces of gravity and inertia in entirely new ways. They are in fact the first unlimited tools the human race has developed.

Just as an airplane cannot leave the earth until it attains flying speed, neither can a spacecraft achieve orbit unless it is given the proper amount of push and proper guidance and control. One mile below flying speed will not do for an airplane as it will never leave the runway. A hundred miles below orbital speed will never do for a spacecraft because it will immediately re-enter the earth's atmosphere. The human intellect has had to learn to calculate precisely the amount of power that must be applied to get up to 18,000 miles an hour, the precise controls required to accurately utilize this power in the right direction at the right time, and how to make use of the orbital position thus achieved.

All this has been done. The earth's atmosphere and weather are being continuously studied by satellites which are the responsibility of the U.S. Weather Bureau. The latest ones incorporate automatic picture transmission systems through which the United States says to every nation, "If you want the weather as seen from above your own country, just tune in on our satellite." We thus say to them, "We want to use these technologies, this new knowledge of the weather, together with you so that we can both live and work in a better world. We do not desire to use these new technologies to achieve power to coerce you."

Moving upward from the 18,000-mile-per-hour speed required for earth orbit, with a little more push, say 25,000 miles per hour, one can coast for two days toward the moon and then enter the moon's field of gravity. The moon will then draw the spacecraft toward it where a proper deceleration, under proper control, will result in a lunar orbit. As you know, our third Lunar Orbiter is in this position now, and a fourth one is on its way, launched last night. On the moon are a number of Rangers which crashed after taking a large number of pictures on the way in and, of course, Surveyors I and III, with Surveyor III still working, even digging trenches under control of human intelligences operating it from 240,000 miles away. This control must be exercised through three stations equally spaced around the circumference of the earth so that as the earth rotates there is no interval during which the moon is not in a line-of-sight position with at least one of these stations.

Looking backward at the Earth from space, the Advanced Technology Satellite out over the Pacific takes a daylight or infra-red picture of one-third of the earth every 20 minutes, transmits this information back for human intelligence to process into usable form, and then relays it downward to the same one-third of the earth that it photographed just a short time before. This is because a rocket engine, using the equivalent power that it takes to go to the moon, placed it above the earth's Equator at a distance of 22,300 miles and at a speed just equalling that at which the earth turns. In that position it remains forever over one spot on the earth, able to see and be seen by instruments spread over one-third of the earth's surface. What about manned exploration of space? Mercury, our first generation vehicle, gave us a tremendous amount of experience. It taught us how to make decisions in from 10 to 20 seconds as to whether the spacecraft, as it crossed the radar and telemetry screen at Bermuda, should be permitted to go on around the earth, or should be dropped in the ocean short of Africa. All did not go right on any Mercury flight, and we clearly proved the correctness of our decision to place stations around the world to permit us to have continuous communication with our manned spacecraft. Gemini, the second generation, demonstrated the correctness of our approach to extremely accurate launches within fractions of a second in order to launch an Agena engine into orbit on one rocket and send the men up on a second launch to join these craft while travelling at 18,000 miles an hour. We learned to use the engine to send the space-built combination up to 850 miles above the earth so astronauts could get a better perspective and could bring back the kind of photographs and measurements that have vastly expanded our knowledge of this earth. But Gemini also gave us experience with up to 14 days of manned operation in space -- you remember the long journey of Astronauts Borman and Lovell in Gemini 7, which extended long after the exciting first rendezvous which Schirra and Stafford accomplished. Gemini taught us something else -- how to get back to Mother Earth at the proper time and place. Who can forget the wonderful photography that provided to millions new concepts of what it means for a spacecraft coming down through the fireball to find a helicopter there to recover the pilots. And also, you remember that when Gemini 8 got into trouble and had to make an emergency landing 500 miles off Okinawa, there was an airplane right over it to spot its location and report the opening of the parachute. This knowledge is the kind of thing I had in mind a few days ago when I stated that the tragic loss of four astronauts, three American and one Russian, might have been prevented through closer cooperation.

Is man with this new technology of the rocket engine ready to propel him upward from the earth and into space to find its use limited to the earth, the moon, and the study of the earth-sun relationships? Clearly not. Mariner 2 went to Venus and gave us important information about that planet. It gave us information that permitted us to compare some of the characteristics of Venus with those of the earth. Mariner 4 went to Mars. In this case it had to be boosted away from the earth at a speed of 27,000 miles an hour. It had to coast eight and a half months to reach Mars. It returned to earth 21 pictures of Mars and, by sending radio signals through the atmosphere of Mars as it went behind the planet and then through the atmosphere on the other side as it emerged, gave us new information about this planet. This one flight greatly enlarged our understanding of the sun, of the earth and of Mars. With this knowledge added to what was known before, scholars are now discussing the possibility of a general theory of planetary atmospheres, and President Johnson is recommending in his 1968 Budget that we land an automatic laboratory on the surface of Mars in 1973 in an effort to determine whether life exists on that planet.

If our future is now more dependent than ever on human intelligence, and if these activities made possible by the rocket engine are adding large increments of grist for the intelligence mill, how much more important is it today than when Cortez Ewing started to teach at this university to understand those institutions of organized society that will foster, encourage, and make proper use of the vast powers the human mind is deriving from its understanding and use of the forces and materials provided by nature in this universe? Last year Carl Albert described for you the process through which the national legislature makes its decisions. Oklahoma's former Senator Robert S. Kerr had a powerful impact on the decision of Congress to utilize these processes to bring into play the machines, forces, and intellectual ferment that I have been describing. His mind knew no limits when it came to the utilization of these wholly new and unlimited tools. He was prepared to struggle with the meaning of such space-age words as magnetohydrodynamics. If he had had his way, the nation's space program would have operated at higher levels and we would have saved more than two years' time. We would have saved three billion dollars in accomplishing the same amount of work. We would already be working on satellites that could give us accurate measures of such resources as the quantity and quality of the wheat crop of the entire earth; that could accurately report the water resources available or to become available, and could bring into play the tremendous new powers which derive from the technology of photographic enhancement, whether to measure progress in urban development or of disease in the human body.

It is a tribute, I believe, to this great university that Cortez Ewing chose to live out his life here, to work with colleagues on the faculty, students and leaders like Carl Albert and Robert S. Kerr. But the work he carried on, the things he made his life stand for, are still unfinished business. Oklahoma needs his qualities to guide its course into the space age. He was here when Oklahoma celebrated its fiftieth anniversary with the motto: "From arrows to atoms." His spirit and his faith must be here to tell us what to do next when an Oklahoman comes home from the moon.

Over and above all else, Ewing understood, and must be honored for it, those processes of political decision and action which are the essence of the American dream. Woodrow Wilson described them in these terms: "The transition we are witnessing is no equable transition of growth and normal alteration, no silent, unconscious unfolding of one age into another, its natural heir and successor. Society is looking itself over, in our day, from top to bottom, is making fresh and critical analysis of its very elements, is questioning its oldest practices as freely as its newest, scrutinizing every arrangement and motive of its life, and stands ready to attempt nothing less than a radical reconstruction...."

We need more men like Ewing today. Students on this and other campuses need them, researchers seeking reality on the earth and in outer space need his vision and his knowledge of the limits which are permissible and, particularly, his skill in relating theory and dynamic action to progress and the avoidance of capture by the forces of anti-progress.

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